Rootstocks have an important role in the apple growing regions. Dwarf stocks are very important in new plantings even though a large portion of the apples grown today are on seedling stocks. All apples that have geen grafted or budded at Gainesville are on seedling stocks. MM106 (approx. 40% dwarfing) gives good production where low-chilling apples are grown commercially in Israel.

The most common method of propagating apple scions is by grafting on seedling or stool-propagated clonal rootstocks. There are a number of grafting methods available but the whip and tongue graft and the shield bud are the most widely used. The whip and tongue graft has been used most at Gainesville because it has the advantage that it can be done throughout the year whereas shield bud is limited to periods when the bark will peel. Shield budding has been used, however, when scion wood was limiting and a maximum number of propagations was desired.

Apples are adapted to a wide range of soils. They are more resistant to temporary flooding than peaches which do best on lighter soils and have been grown at Gainesville in places where peaches have died from "wet feet". They will not be thrifty or long lived if their roots are in soils subject to prolonged saturation.

Most apples are self-unfruitful and require cross-pollination for full cropping. Partial pollination of the pistils will often result in set of fruit containing 1 or 2 seeds. A high percentage of fruit that set with few seeds and those in which embryo abortion occurs will drop before maturity. 'Anna' and 'Ein Shemer' overlap in bloom at Gainesville. Fruits from these 2 varieties planted near the seedling block at Gainesville contained 6 to 8 seeds each in 1971.

'Anna' is considered a more desirable variety in Israel than 'Ein Shemer', which is its principal pollinator. A planting ratio favors 'Anna' there. Both varieties are equally desirable at Gainesville, thus a ratio of 1 to 1 is feasible.

Two of the most serious diseases of apple are fire blight and scab. Fire blight has not seriously attacked any low-chilling seedling apple trees at Gainesville even though they are grown within a few feet of blight-infected pear trees. However, 1 branch of 'Anna' topworked on an older seedling appeared to have a blight canker. Apple scab is a serious problem at Gainesville where no attempt has been made for control. 'Anna' appears to be susceptible and 'Ein Shemer' resistant. Scab is controlled in commercial apple regions with Captan applications at 1 to 2 week intervals from bloom. Fruit splitting has resulted from high rainfall following a prolonged drought and fruit rot organisms have invaded the fruit at time of ripening. Irrigation during the dry season should reduce fruit splitting. It is probable that some spraying will be needed to protect ripening fruit from rots.

These low-chilling apples should prove useful plants for home production in Central Florida. In addition, they provide valuable germplasm for breeding better apples with a low winter cold need.

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PROGRESS OF THE NECTARINE

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ABSTRACT

Nectarines have been greatly improved by breeding in the past 30 years. They may rival peaches for fresh market shipment from California in the next decade, but have made little impact in humid summer peach regions of eastern United States.

Florida started a program in 1956 for development of adapted varieties with 200 to 600 hour chilling requirements. Three varieties and 31 prom-

ising selections have been obtained from over 8000 hybrids and second generation seedlings. Over 700 acres of commercial plantings have been made, and prospects are very favorable for considerable expansion.

Introduction

The nectarine has been aptly described by Hedrick (7) as a "hairless peach," usually with smaller and firmer fruit, more aroma, richer flavor, but otherwise similar to peach in tree characteristics. He stated that its written history goes back 2,000 years, then merges into that of the peach. Its behavior in breeding as a recessive character was reported by Rivers (17) in 1907 and confirmed before 1937 (5). Nectarines have historically been of little importance relative to peaches, with fewer varieties available (Table 1).

Bud mutations of peaches to nectarine (13) and nectarine seedlings from peach seeds occur in peaches that carry the recessive gene for the nectarine character. Much smaller fruit size has been generally associated with the nectarine type suggesting close linkage of size genes or possibly inheritance of a chromosome segment. In recent years, the size problem has been considerably overcome in breeding.

In spite of the knowledge that peach and nectarine behave as simple dominant-recessive characters, much of the public probably still feel as Wellington (20) reported in 1924 when 9 of 10 people at the New York State Fair said "Look at the plums."

Economic Importance Resulting from Variety Improvement

The economic value of nectarines can best be discussed with reference to variety development. This fruit was grown in glasshouses in England and France in the 1800's, but most varieties were small and poorly colored by current standards. These varieties were not satisfactory for open culture in the eastern U.S., but were the hopes for a breeding foundation and 1 variety was released in New York in 1924 (20). Only 400 seedlings of peach and nectarine were reported from breeding in New York in 1937, and these evidently were mostly peach or first generation hybrids (5). New Jersey also reported some work with nectarines before 1937. During this period efforts were also being made in California to test and improve the nectarine (Table 1) (5). The status of nectarines in the U.S. in 1938, was that in the East, the fruit was ruined by curculio and brown rot and the West could not ship the fruit long distances because of bruising and loss from decay (8). The New Jersey and Virginia Agricultural Experiment Stations have continued breeding of this fruit and there have been hopes (18) of making the nectarine successful in the humid summer regions of the U.S. Breeding work in California was intensified by private breeders and 'Le Grand', 'Bim' and 'Kim', the first in a long series of patented varieties, were introduced by F. W. Anderson from 1938 to 1944 (2). Emphasis was on obtaining larger fruit of attractive color, yellow-fleshed, and firm enough for long-distance shipment, sometimes at the expense of flavor. 'Sungrand' in 1950, 'Merrill Sunrise' in 1953, and others introduced from 1951 to 1955 were the foundation for an expanded industry and in turn an impetus for further breeding. New varieties to extend the season or as improvements over older varieties have been introduced in increasing numbers (Table 2). The non-patented varieties developed by Dr. J. H. Weinberger, U.S.D.A. accounted for 42% of trees reported sold in California in 1971.

Early ripening California varieties are of most interest to the Florida industry. 'Merrill Sunrise',

Table 1. Number of peach and nectarine varieties listed in several references.

Year	Peach	Nectarine	Literature Source
1831	104	24	Prince (16)
1906	30	14	Bunyard (3)
1921	48	10	Wickson (21)
1932	25	14	Philp and Davis (15)
1937 (Davis, Cal.)	261	59	Cullinan (5)
(Rutgers, N.J.)	245	25	
(USDA, MD.)	174	11	
(Experiment,Ga)	68	1	
1938	120	16	Hedrick (8)
1953	61	16	Brooks and Hesse (1)

Table 2. Introduction of nectarine varieties in USA (adapted from Register of New Fruits and Nut Varieties, Amer.Soc.Hort.Sci.)

New Varieties	Calif.	Other(1)	Total
1920-1950	13	10	23
1951-1960	42	7	49
1961-1970	38(2)	21	59
Totals	93	38	131

(1) N.J. 16, Va. 7, N.Y. 4, Fla. 2, Tex. 2, and 1 each for Ala., Mich., Neb., Ore., Italy and Russia.

(2) Includes 4 named by Stark nursery from eastern USA tests.

Table 3. Acreage and production[1] of California peaches and nectarines grown for fresh market.

Year	Peaches Tons (000)	Nectarines Tons (000)	Acres (000)	Literature Sources
1932	65.2		2.3	Philp, et al (15), Kip (11)
1950	118.1	11.7	2.9	Olmo (14), Kip (11)
1960	117.4	43.0	11.9	Olmo (14), Kip (11)
1961-65	114.9	58.7	9.2	Kip et al (11)
1970	81.0	64.6	12.9	(4) and Calif. Crop and Livestock Reporting Service.
1980 Est.	139.3	82.8	10 to 13	Kip et al (11)

[1]California production currently represents 20 to 30% of total U. S. fresh peaches and nearly 100% of nectarines.

first ripe about June 3 (range May 25 to June 19), now becoming obsolete, and 'Early Sungrand', about June 12, have been the important early varieties. Since 1958, at least 8 varieties have been described as ripening with or before 'Sunrise'. These very early varieties totaled 33% of all nectarine trees reported sold in the 1969 to 1971 seasons compared to about 15% in older plantings (Table 4). This suggests at least a doubling of early June production, with some overlap into May in some seasons. Chilling requirements of these and older varieties from California are generally as high as 'Elberta' peach (12, 19).

World-wide, the improved U.S. nectarines have not been planted until recently. A 1966 report (10) does not mention nectarines as a fruit industry in any other parts of the world. The latest French and Italian nursery catalogs offer several U.S. varieties and plantings have increased (6, 9). New varieties of Dr. Weinberger, and several developed by Drs. Hough and Bailey of Rutgers University in New Jersey as well as 'Sunred' from Florida, are reported of much interest in Italy (6).

Nectarines are essentially a California monopoly where volume has increased relative to peach (Table 3). Recent planting figures may mean that California production projections for 1980 (11), based on 1961-65 values, will be too high for peaches and too low for nectarines. Freestone peaches have been marketed 40% or less as fresh fruit in recent years. On the basis of 40% and assuming similar production per acre, the standing acreage for fresh market in 1970 would total 11,587 of peaches and 12,969 of nectarines. Bearing trees 10 years of age or older would be respectively 7,458 and 6,132, 5 to 9 year old trees 1,662 and 1,659 while non-bearing acreage would be 2,467 and 5,178. The 1970-71 tree sales of nectarines were even higher relative to freestone peaches than in previous years. These large shifts in plantings may result in nectarine shipments equal to or greater than fresh peaches from California by 1980.

There has generally been a distinct price advantage of nectarines over peaches but this has varied. Some of the older varieties, now considered of inferior quality, such as 'Le Grand' and 'Late Le Grand', often sell for less than peaches. From 1947 to 1949, nectarines sold for the same to 20% higher prices in eastern U.S. markets than California freestone peaches. During 1950 to 1959, nectarines sold 30 to 90% higher but from 1960 to 1965, only 0 to 20% higher for nectarines. Since 1966, prices have generally averaged 15 to 20% higher for nectarines.

Florida Variety and Industry Developments

The peach breeding program began at Gainesville in 1952, and the nectarine character was included in crosses in 1956 with peaches of low chilling requirements. Second-generation and backcross progeny began to give nectarines of low chilling requirements in 1960. 'Sunred' was selected

Table 4. Early ripening nectarines in California [1]

Variety	Year Introduced	Initial Harvest [3]	Prices [4] 1969	Prices [4] 1970	Hundreds of Trees Sold [2] Before 1968	1968 1969	1969 1970	1970 1971	Total
Armking	1969	June 1			0	0	293	186	479
Crimson Gold	1968	2-6	$4.70		20	15	3	0	38
June Grand	1958	6	5.30	$ 6.89	20±	1	1	0	22
Mayfair	1964	3	3.75	11.41	18±	28	6	15	67
May Grand	1967	1		6.44	260	722	229	118	1,329
Mayred	1967	1			0	0	12	33	45
Red June	1961	8	4.41	5.81	800±	93	34	11	938
Scarlet Queen	1968	1			0	0	50	0	50
Sunrise (Merrill)	1952	3	3.76	4.30	450±	0	0	0	450
Total Very Early Vars.					1,568±	859	628	363	3,418
Early Sun Grand	1955	12	4.18	4.37	2,000±	79	51	18	2,148
All Varieties			3.86	4.11	10,000±	1,948	1,436	2,137	15,000±

[1] Adapted from reports of California Crop and Livestock Reporting Service, California Tree Fruit Agreement and U.S.D.A. Federal-State Market News Service.(4)

[2] Reported acreage figures are about 10% less than hundreds of trees reported sold.

[3] Initial harvest dates of June Grand, Red June and Sunrise are averages of 10 to 12 years. Sunrise has varied from May 25 to June 19. Newer varieties have been estimated from limited data and introduction descriptions.

[4] Average prices per 22 pound lug at several eastern U.S. auctions.(4)

in 1961 and introduced in 1964. Commercial plantings of this variety started in 1965 and now exceed 700 acres in central Florida. Production and prices in 1969 and 1970 were very encouraging but late frosts in March reduced the crop of this 300 hour low-chilling variety in 1971. 'Sungold' introduced in 1969 and 'Sunrich' in 1971 are in only small plantings. They have chilling requirements of about 550 hours, blooming late in north central Florida, but relatively early in northwest Florida. Their ripening dates of early to mid-June will not insure freedom from competition with California varieties.

The success of 'Sunred' has encouraged more emphasis on breeding of nectarines to provide varieties ripening throughout the month of May. It may be noted from Table 5 that the hybrids with nectarine as 1 or both parents were 21 in number in 1956, 345 in 1958, and 752 in 1959. During 1960 to 1965, only 447 additional hybrids were made, but the selection of open-pollinated seedlings on a larger scale was expanded. From 1966 to 1970, despite a complete loss in 1967, from freezing, 2635 more hybrids were obtained, in addition to even more open-pollinated seedlings. Most of the crosses in these later years were with nectarine parentage only in contrast to the earlier years when 1 parent was a peach.

The parentage of varieties and selections being tested in increase plots in 1971 is given in Table 6. It can be noted that a rather broad spectrum of prominent nectarine varieties is represented, and that all carry some background of the South China type peaches, 'Okinawa' or 'Hawaiian' from the first crosses in 1956. Of the 34 selections listed, about 25 have chilling requirements of 200 to 400 hours, with the balance in the 450 to 600 hour range. From these it is hoped to fill the gap in ripening dates between 'Sunred' in central and 'Sungold' in northern Florida with 4 or 5 commercial quality varieties in the period from May 8 to June 10. Unlike peaches, there is no competition from other eastern U.S. regions. The central Florida climate is relatively dry from February to May, averaging slightly over 3″ rainfall per

Table 5. F1 hybrids for nectarines in Florida (an equal or greater number of open-pollinated seedlings were grown from these F1 hybrids)

Year	Number of F1 seedlings	Principle parentage
1956	21	Okinawa, Jewel, or (Southland X Hawaiian) X Panamint
1958	345	Hybrids of 1956 breeding X NJN 21 and NJ 5107397
1959	752	Hybrids of 1956 breeding and (Okinawa X Maygold or Southland) X NJN 21, Merrill Sunrise, Palomar, or Sungrand
1961	292	F1 to third generation selections from combinations of (Okinawa, Hawaiian, Jewel and Red Ceylon X Southland, Panamint, and Sungrand) X Merrill Princess
1962	60	Second and third generation selections involving Southland, Panamint, Jewel and Hawaiian X Cavalier
1963	63	F1 and second generation selections involving Panamint, Jewel, Okinawa, or Flordasun X Early Sungrand
1965	32	Florida peach and nectarine selections X Sunred
1966	732	Florida nectarine selections X NJN54, NJ551025 and Florida 5-107
1968	893	Sungold and sister seedlings X Sunred, Florida 5-107, and 18-102 nectarines
1969	500	Intercrosses of Florida nectarine selection; a few Florida nectarines X Springcrest
1970	510	Intercrosses of Florida nectarine selections.
Totals	4,200	

See Table 6 for parentage of numbered selections.

month. Combined with sandy soils, fairly high temperatures and infrequency of prolonged showers until June, brown rot control has not been difficult in this climate. Somewhat more brown rot occurs in northern Florida, but good spray programs have given control. Plum curculio has been controlled well with the normal peach spray programs. Each region has developmental problems with both peaches and nectarines, because of the newness of this industry. No prior cultural experience, poor sites, unsatisfactory soil, poor air drainage, and insufficient information on pest control, are the most common problems plus of course, the need for new varieties. Another site problem, mushroom root rot, has occasionally been serious. Central Florida has perhaps the greater problems associated with inexperience and poor sites, but this is countered by the market advantage of 2 to 3 weeks earlier maturity of current and prospective nectarine varieties.

There are few published figures on the production of nectarines in Florida. Estimates are that

Table 6. Parentage of 34 nectarine selections and yarieties of interest in Florida in 1971.

Number	Parentage	Named Varieties and Selections
2	[Panamint X (Southland X Hawaiian, op)], op	Sunred, 44-67
2	NJ5107397 X (Ok X Panamint)	Sungold, Sunrich
2	NJ5107397 X (Ok X Panamint), op	Q12-39,65-100
1	[NJ5107397 X (Ok X Panamint)], X 5-107	15-85W
3	[(Ok X Maygold) X Merrill Sunrise], op	1-12,18-101,18-102
2	[(Ok X Maygold) XMerrill Sunrise] X 5-107	2E71, 6E13
1	(Ok X Panamint) X NJN 21	44-28
3	[(Ok X Panamint) X NJN 21] op	5W138,5W139,5E142
1	(Ok X Panamint), op X Early Sungrand	61-46
1	[(Ok X Panamint) X Merrill Sunrise]	69-83
6	[(Southland X Hawaiian) X Palomar], op	8E115, 8W119,8W124, 8W126,8E128,8E131
3	(4-65X68-50) X 5-107	5E5,5E16,5W35
2	(5-103 X 68-50), X NJN54	5E58, 5E116
2	5-107 X NJ551025	6E24, 6W41
1	(Flordawon X Merrill Princess) op	7E62
2	Sunred X NJ551025	8W3,8E16
34 Total		

Op= open-pollinated seedling

4-65= (Southland X Hawaiian) X Palomar

5-103, 5-107=[(Southland X Hawaiian) X Palomar] X [Panamint X (Southland X Hawaiian)]

68-50=Panamint X (Southland X Hawaiian)

NJN 5107397=(Candoka X Flaming Gold) X [(Garden State X NJ25032) o.p.]

NJN 21=Cardinal nect. X (Candoka X Flaming Gold)

NJN 54, NJ 551025 =Complex parentage includes, Candoka, Flaming Gold, Garden State and NJ 25032

Ok = Okinawa

Table 7. Reported U.S. shipments of early nectarines by weeks, 1970.

Origin	May 10 - May 16	May 17 - May 20	May 24 - May 30	May 31 - June 6	June 7 - June 13	Totals to June 13
	Cars and carlot equivalents - 34,500 lbs. per car					
California	3	5	2	19	89	118[1]
Florida	3	16	10	2	0	31
U.S. Totals	6	21	12	21	89	149

[1]New plantings suggest this volume will more than double by 1975 or later.

yields may not average more than 3 tons per acre and perhaps even less compared to about 6 tons indicated in Table 3 for California. This is likely for the following reasons: (a) shorter life expectancy of trees in Florida, increasing the ratio of non-bearing to bearing trees, (b) emphasis on early ripening varieties which traditionally bear less than longer-cycle varieties, (c) methods of pruning in which all fruit is picked from the ground from smaller trees and (d) greater hazards to cropping from late frosts, variable winter chilling, etc. On the other hand, prices received for packed fruit at point of origin for the limited quantities of 'Sunred' fruit so far marketed from Florida have been 30 to 40 cents per pound. Prices for very early California nectarines averaged 25 cents F.O.B., California, in 1969 and 1970 (4). New York auction prices varied widely from 17 to 51 cents per pound depending on variety and quality (4) (Table 4). An important factor in pricing in addition to small volume, is that Florida 'Sunred' has been shipped with or ahead of most U.S. peaches, before any plums, or any volume of other fresh fruit such as grapes or melons. It is presumptious to make firm predictions of the market potential for Florida nectarines but with further development of acceptable varieties, the market should be as large in May as for any later month. California shipped about 61,000 tons of fruit from mid-May through September in 1970. Shipments of 118 carlots (17 ¼ T. per carlot) were reported from California and 31 from Florida up to June 13th (Table 7). Nectarine shipments peak at 60 carlots daily in mid-July. Canada, and eastern, southern and midwestern U.S. markets receive about 75% of the nectarine crop. The large mid-season volume coincides with fresh peaches, plums, grapes, and melons at peak harvest.

Variety development and climatic conditions in Florida should permit about 4 weeks of harvesting before much competition from California nectarines. With the right varieties, on proper sites and development of grower experience, a 10 to 12-fold increase of the current nectarine industry in Florida should be a conservative potential. Many areas of the world with a relatively dry climate during fruit development and camparable winter chilling (coldest month mean 13 to 16°C) should find the new Florida nectarines useful. Favorable reports on 'Sunred' have been received from Italy, Israel, Peru, and the Canary Islands.

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PECANS IN CENTRAL AND SOUTH FLORIDA

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ABSTRACT

This paper reports the results of a survey made to evaluate the relative success of pecans in central and south Florida. One hundred and forty-one trees were evaluated in the region between Ocala and Miami. Most of these trees were making satisfactory growth and producing fair yields of good quality nuts. A number of varieties, especially 'Curtis', are apparently suitable for this area. Normally pecans will not successfully compete with citrus for the preferred well-drained sites due to the low return per acre and lack of precocity. However, pecans may be grown in areas too cold for citrus such as low sites or the northern portion of the citrus region.

INTRODUCTION

No plant is more truly American than *Carja illinoensis*, the pecan, for it is indigenous only to the North American Continent. Native trees are found along streams and flood plains from Eastern Mississippi to the high plains of Texas and northward to Indiana and Kansas. The species is not native in Florida, though several other hickories are common. The growing of pecans in Florida began about 1820 when early settlers grew trees to produce nuts for home consumption.

According to a survey conducted by the Florida Cooperative Extension Service in 1970, there are approximately 8,000 acres of pecans currently grown in Florida (the survey included only orchards of 5 acres and larger). Florida growers market about 5 million pounds of pecans each year. Approximately ½ of these are from seedling trees with the remainder from grafted named varieties. The predominant varieties grown in Florida are 'Stuart', 'Curtis', 'Schley', 'Moneymaker', 'Success', and 'Mahan'. A considerable quantity of 'Desirable' and 'Elliott' trees are being planted.

The pecan growing region of Florida has traditionally been the area north of Ocala extending to the western tip of the Peninsula. A survey in 1945 reported 7,297 pecan trees south of Ocala (1). There have been varying reports regarding the success of pecan production in these areas. In 1914, Mr. E. A. Davenport (3) gave the following report at the National Nut Growers' Convention in Thomasville, Georgia. "While admitting that Marion County is in fact the southern limit of profitable pecan culture at the present time, I believe that it is only so because the culture of the nut has not been attempted south of that point on any adequate scale".

A survey was made this year to evaluate the relative success and potential of growing pecans in central and south Florida.

RESULTS AND DISCUSSION

During the past 4 months, 141 pecan trees have been located and evaluated in the region between